OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **Horseshoe Pond, Concord** the program coordinators have made the following observations and recommendations.

Welcome to the New Hampshire Volunteer Lake Assessment Program! As your group continues to participate in VLAP each summer, the database created for your pond will help your monitoring group track water quality trends and will ultimately enable your group and DES to identify potential pollutant sources from the watershed that may affect pond quality.

Congratulations on sampling your pond **13** times this summer! As a rule of thumb, please try to sample at least once per month during the summer months (**June**, **July**, and **August**). In addition, it may be necessary to conduct rain event sampling at multiple locations along a stream using the bracketing technique to identify sources of pollution. Furthermore, baseline studies could involve bi-weekly or monthly sampling for an extended period of time. DES will let you know if this type of sampling is appropriate.

We understand that future sampling will depend upon volunteer availability, and your group's goals and funding availability. We would like to point out that **water quality trend analysis is not feasible with only a few data points.** It will take many years to develop a statistically sound set of water quality baseline data. Specifically, after 10 consecutive years of participation in the program, we will be able to analyze the in-lake data with a simple statistical test to determine if there has been a significant change in the annual mean chlorophyll-a concentration, Secchi disk transparency reading, and phosphorus concentration. Therefore, frequent and consistent sampling will ensure useful data for future analyses.

Please contact the VLAP Coordinator early this spring to schedule the annual DES lake visit. **It would be best to schedule the DES visit for early June to refresh your sampling skills!**

Finally, please remember that one of your most important responsibilities as a volunteer monitor is to educate your association, community, and town officials about the quality of your pond and what can be done to protect it! DES biologists may be able to assist you in educating your association members by attending your annual lake association meeting. Remember to schedule biologists early for your lake association meeting.

The Horseshoe Pond volunteer monitoring project was a cooperative effort between the Society for the Protection of New Hampshire Forests, the City of Concord, and the NH Department of Transportation (DOT), and the NH Department of Environmental Services (DES). Horseshoe Pond and its watershed are a valuable resource within the City of Concord; supporting agricultural lands, and a diverse flora and fauna. The pond is surrounded by commercial development, active agricultural lands, residential, and industrial use. The purpose of the intensive summer water quality monitoring program was to assess water quality parameters and whether they exceed water quality standards for recreational and aquatic life use support. Waterbodies impaired for these categories are eligible to apply for a watershed restoration grant to assist with remediation activities to fully support these uses. Based on the water quality data collected in 2008, Horesehoe Pond exceeds water quality parameters for conductivity, chlorophyll-a and total phosphorus.

Watershed land use is characterized by a large amount of impervious surfaces, decreasing infiltration into the ground, and increasing stormwater volume and flow into the pond. High volume storm events often result in flooded streets and high water levels in the pond, flooding agricultural fields. The City of Concord and DOT are interesting in retrofitting the stormwater infrastructure to increase stormwater flow into Horseshoe Pond. Before this can happen, existing pollutant loads and sources must be identified, and remediation activities and best management practices implemented to restore Horseshoe Pond to fully supporting its designated uses. Therefore, the City of Concord has applied for a Watershed Restoration Grant from the DES Watershed Assistance Section.

Variable milfoil (*Myriophyllum heterophyllum)* was identified in Horseshoe Pond on 5/21/2008. DNA testing confirmed the findings. The milfoil currently covers about 3/4 of the East side of Horseshoe Pond; however it was only sporadic in the West side. DES Biologists will conduct a site inspection to map and assess the infestation during the summer of 2009.

FIGURE INTERPRETATION

CHLOROPHYLL-A

- **Figure 1 and Table 1:** Figure 1 in Appendix A shows the historical and current year chlorophyll-a concentration in the water column.

Table 1 in Appendix B lists the maximum, minimum, and mean concentration for each sampling year that the pond has been monitored through VLAP.

Chlorophyll-a, a pigment found in plants, is an indicator of the algal abundance. Algae (also known as phytoplankton) are typically microscopic, chlorophyll producing plants that naturally occur in lake ecosystems. The chlorophyll-a concentration measured in the water gives biologists an estimation of the algal concentration or lake productivity. **The median summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 4.58 mg/m^3.**

EAST STATION
The current year data (the top graph) show that the chlorophyll-a concentration ***increased gradually*** from **June** to **August**. Chlorophyll-a concentrations on the **7/14/2008 (16.87 mg/m^3) and 8/5/2008 (18.84 mg/m^3)** sampling events were ***elevated***. Typically, chlorophyll-a concentrations above **15 mg/m^3** are indicative of an algal bloom.

Please note that multiple chlorophyll-a samples were collected each month and the results averaged.

Please note that the chlorophyll-a value for May was incomplete due to a laboratory error. We apologize for this inconvenience.

The historical data (the bottom graph) show that the **2008** chlorophyll-a mean is ***greater than*** the state and similar lake medians. For more information on the similar lake median, refer to Appendix F.

WEST STATION
The current year data (the top graph) show that the chlorophyll-a concentration ***decreased*** from **May** to **June**, and ***increased steadily*** from **June** to **August**. The chlorophyll-a concentration on the **8/5/2008 (36.45 mg/m^3)** sampling event was ***elevated***. Typically, chlorophyll-a concentrations above **15 mg/m^3** are indicative of an algal bloom.

Please note that multiple chlorophyll-a samples were collected each month and the results averaged.

The historical data (the bottom graph) show that the **2008** chlorophyll-a mean is ***greater than*** the state and similar lake medians. For more information on the similar lake median, refer to Appendix F.

Please keep in mind that these observations are based on only one year of data. As your group expands its sampling program, we will be able to determine trends with more accuracy and confidence.

After 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historical data to objectively determine if there has been a significant change in the annual mean chlorophyll-a concentration since monitoring began.

While algae are naturally present in all lakes and ponds, an excessive or increasing amount of any type is not welcomed. In freshwater lakes and ponds, phosphorus is the nutrient that algae typically depend upon for growth in New Hampshire lakes. Algal concentrations may increase as nonpoint sources of phosphorus from the watershed increase, or as in-lake phosphorus sources increase. Therefore, it is extremely important for volunteer monitors to continually educate all watershed residents about management practices that can be implemented to minimize phosphorus loading to surface waters.

TRANSPARENCY

- **Figure 2 and Tables 3a and 3b:** Figure 2 in Appendix A shows the historical and current year data for transparency with and without the use of a viewscope. Table 3a in Appendix B lists the maximum, minimum and mean transparency data without the use of a viewscope and Table 3b lists the maximum, minimum and mean transparency data with the use of a viewscope for each year that the pond has been monitored through VLAP.

  Volunteer monitors use the Secchi disk, a 20 cm disk with alternating black and white quadrants, to measure how far a person can see into the water. Transparency, a measure of water clarity, can be affected by the amount of algae and sediment in the water, as well as the natural color of the water. **The median summer transparency for New Hampshire's lakes and ponds is 3.2 meters.**

  EAST STATION
  The current year data (the top graph) show that the non-viewscope in-lake transparency ***decreased*** from **May** to **July**, and then ***increased*** from **July** to **August**.

  Please note that multiple transparency readings were conducted each month and the results averaged.

The historical data (the bottom graph) show that the **2008** mean non-viewscope transparency is ***slightly less than*** the state and similar lake medians. Please refer to Appendix F for more information about the similar lake median.

The current year data (the top graph) show that the viewscope in-lake transparency was ***approximately equal to*** the non-viewscope transparency on the **May** sampling event. The transparency was ***not*** measured with the viewscope on the **June**, **July** or **August** sampling events. As discussed previously, a comparison of transparency readings taken with and without the use of a viewscope shows that the viewscope typically increases the depth to which the Secchi disk can be seen into the lake, particularly on sunny and windy days. We recommend that your group measure Secchi disk transparency with and without the viewscope on each sampling event.

It is important to note that viewscope transparency data are not compared to a New Hampshire median or similar lake median. This is because lake transparency with the use of a viewscope has not been historically measured by DES. At some point in the future, the New Hampshire and similar lake medians for viewscope transparency will be calculated and added to the appropriate graphs.

WEST STATION

The current year data (the top graph) show that the non-viewscope in-lake transparency ***increased*** from **May** to **June**, ***decreased*** from **June** to **July**, and then ***increased*** from **July** to **August**.

Please note that multiple transparency readings were conducted each month and the results averaged.

It is important to note that as the chlorophyll concentration ***decreased*** from **May** to **June**, the transparency ***increased***, and as the chlorophyll ***increased*** from **June** to **July**, the transparency ***decreased***. We typically expect this ***inverse*** relationship in lakes. As the amount of algal cells in the water ***increases***, the depth to which one can see into the water column typically ***decreases***, and vice-versa.

The historical data (the bottom graph) show that the **2008** mean non-viewscope transparency is ***slightly less than*** the state and similar lake medians. Please refer to Appendix F for more information about the similar lake median.

The current year data (the top graph) show that the viewscope in-lake transparency was ***slightly greater than*** the non-viewscope transparency on the **May** sampling event. The transparency was ***not*** measured with the viewscope on the **June**, **July** or **August** sampling events. As discussed previously, a comparison of transparency readings taken with and without the use of a viewscope shows that the viewscope typically increases the depth to which the Secchi disk can be seen into the lake, particularly on sunny and windy days. We recommend that your group measure Secchi disk transparency with and without the viewscope on each sampling event.

Please keep in mind that these observations are based on only one year of data. As your group expands its sampling program, we will be able to determine trends with more accuracy and confidence.

Again, please keep in mind that this observation is based on only ***one*** year of data. As previously discussed, after 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historical data to objectively determine if there has been a significant change in the annual mean transparency since monitoring began.

Typically, high intensity rainfall causes sediment-laden stormwater runoff to flow into surface waters, thus increasing turbidity and decreasing clarity. Efforts should continually be made to stabilize stream banks, lake and pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the lake and pond. Guides to best management practices that can be implemented to reduce, and possibly even eliminate, nonpoint source pollutants, are available from DES upon request.

TOTAL PHOSPHORUS

- **Figure 3 and Table 8:** The graphs in Figure 3 in Appendix A show the amount of epilimnetic (upper layer) phosphorus and hypolimnetic (lower layer) phosphorus; the inset graphs show current year data. Table 8 in Appendix B lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the pond has been sampled through VLAP.

  Phosphorus is typically the limiting nutrient for vascular plant and algae growth in New Hampshire's lakes and ponds. Excessive phosphorus in a lake or pond can lead to increased plant and algal growth over time. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 12 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

EAST STATION
The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration ***increased steadily*** from **May** to **July**, and then ***decreased*** from **July** to **August**.

Please note that multiple phosphorus samples were collected each month and the results averaged.

The ***elevated*** epilimnetic phosphorus concentration measured on the **6/29/2008 (31 ug/L)** and **7/14/2008 (57 ug/L)** sampling events may be a result of phosphorus-enriched stormwater runoff that flowed into the surface layer of the pond. Weather records show that approximately **1.0 inch and 0.5 inches** of rain fall were measured **24 hours** prior to sampling.

The historical data show that the **2008** mean epilimnetic phosphorus concentration is ***much greater than*** the state and similar lake medians. Refer to Appendix F for more information about the similar lake median.

Please note that the hypolimnetic phosphorus concentration was not measured at this station. This station does not thermally stratify into lake layers; therefore it in not necessary to collect a hypolimnion sample.

WEST STATION
The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration ***increased steadily*** from **May** to **July**, and then ***decreased*** from **July** to **August**.

Please note that multiple phosphorus samples were collected each month and the results averaged.

The ***elevated*** epilimnetic phosphorus concentration measured on the **7/14/2008 (31 ug/L)** sampling event may be a result of phosphorus-enriched stormwater runoff that flowed into the surface layer of the pond. Weather records show that approximately **0.5 inches** of rain fall were measured **24 hours** prior to sampling.

The historical data show that the **2008** mean epilimnetic phosphorus concentration is ***greater than*** the state and similar lake medians. Refer to Appendix F for more information about the similar lake median.

The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration ***increased gradually*** from **May** to **July**, and then ***increased sharply*** from **July** to **August**.

The hypolimnetic (lower layer) turbidity sample was ***elevated*** on the **8/11/2008** sampling event (**4.54 NTUs**). This suggests that the pond bottom may have been disturbed by the anchor or by the Kemmerer Bottle while sampling and/or that the pond bottom is covered by an easily disturbed thick organic layer of sediment. When the pond bottom is disturbed, phosphorus rich sediment is released into the water column. When collecting the hypolimnion sample, make sure that there is no sediment in the Kemmerer Bottle before filling the sample bottles.

The historical data show that the **2008** mean hypolimnetic phosphorus concentration is ***much greater than*** the state and similar lake medians. Please refer to Appendix F for more information about the similar lake median.

Please keep in mind that these observations are based on limited data. As your group expands its sampling program, we will be able to determine trends with more accuracy and confidence.

As discussed previously, after 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historical data to objectively determine if there has been a significant change in the annual mean phosphorus concentration since monitoring began.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about the watershed sources of phosphorus and how excessive phosphorus loading can negatively affect the ecology and the recreational, economical, and ecological value of lakes and ponds.

TABLE INTERPRETATION

- **Table 2: Phytoplankton**
  Table 2 in Appendix B lists the current and historical phytoplankton and/or cyanobacteria observed in the pond. Specifically, this table lists the three most dominant phytoplankton and/or cyanobacteria observed in the sample and their relative abundance in the sample.

  EAST STATION
  The dominant phytoplankton and/or cyanobacteria observed in the **May** sample were ***Dinobryon*** **(Golden-Brown),** ***Asterionella*** **(Diatom),** and ***Tabellaria*** **(Diatom)**.

WEST STATION
The dominant phytoplankton and/or cyanobacteria observed in the **May** sample were ***Dinobryon*** **(Golden-Brown),** ***Asterionella*** **(Diatom),** and ***Synedra*** **(Diatom)**.

Phytoplankton populations undergo a natural succession during the growing season. Please refer to the "Biological Monitoring Parameters" section of this report for a more detailed explanation regarding seasonal plankton succession. Diatoms and golden-brown algae populations are typical in New Hampshire's less productive lakes and ponds.

- **Table 4: pH**
Table 4 in Appendix B presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 6.0 typically limits the growth and reproduction of fish. A pH between 6.0 and 7.0 is ideal for fish. The median pH value for the epilimnion (upper layer) in New Hampshire's lakes and ponds is **6.6**, which indicates that the state surface waters are slightly acidic. For a more detailed explanation regarding pH, please refer to the "Chemical Monitoring Parameters" section of this report.

The mean pH at the **East Station** deep spot this year was **6.46** in the epilimnion, and the mean pH at the **West Station** deep spot ranged from **6.45** in the hypolimnion to **6.97** in the eplimnion, which means that the water is ***slightly acidic***.

It is important to point out that the **West Station** hypolimnetic (lower layer) pH was ***lower (more acidic)*** than in the epilimnion (upper layer). This increase in acidity near the pond bottom is likely due to the decomposition of organic matter and the release of acidic by-products into the water column.

Due to the state's abundance of granite bedrock and acid deposition received from snowmelt, rainfall, and atmospheric particulates, there is little that can be feasibly done to effectively increase pond pH.

- **Table 5: Acid Neutralizing Capacity**
Table 5 in Appendix B presents the current year and historical epilimnetic ANC for each year the pond has been monitored through VLAP.

Buffering capacity (ANC) describes the ability of a solution to resist changes in pH by neutralizing the acidic input. The median ANC value for New Hampshire's lakes and ponds is **4.8 mg/L**, which indicates that many lakes and ponds in the state are at least "moderately vulnerable" to acidic inputs. For a more detailed explanation about ANC, please refer to the "Chemical Monitoring Parameters" section of this report.

The mean epilimnetic acid neutralizing capacity (ANC) was **30.9 mg/L** at the **East Station**, and **22.8 mg/L** at the **West Station**, which is ***much greater than*** the state median. In addition, this indicates that the pond is ***not vulnerable*** to acidic inputs.

- **Table 6: Conductivity**

Table 6 in Appendix B presents the current and historical conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current, which is determined by the number of negatively charged ions from metals, salts, and minerals in the water column. The median conductivity value for New Hampshire's lakes and ponds is **38.4 uMhos/cm**. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The mean annual epilimnetic conductivity at the deep spot this year was **778.86 uMhos/cm** at the **East Station**, and **483.86 uMhos/cm** at the **West Station**, which is ***much greater than*** the state median.

The conductivity was ***much greater than*** the state median in the pond and tributaries this year. Typically, elevated conductivity indicates the influence of pollutant sources associated with human activities. These sources include failed or marginally functioning septic systems, agricultural runoff, and road runoff, which contains road salt during the spring snow-melt. New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could also contribute to increasing conductivity. In addition, natural sources, such as iron and manganese deposits in bedrock, can influence conductivity.

We recommend that your monitoring group conduct stream surveys and rain event sampling along the tributaries with ***elevated*** conductivity so that we can determine what may be causing the increases.

For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special *topic article, which is posted on the VLAP website at* ***http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm****, or contact the VLAP Coordinator.*

De-icing materials applied to nearby roadways during the winter months are influencing the conductivity in the pond. The most commonly used de-icing material in New Hampshire is salt (sodium chloride).

A limited amount of chloride sampling was conducted during ***2008****. Please refer to the discussion of* ***Table 13*** *for more information.*

Therefore, we recommend that the **epilimnion** and the **tributaries** be sampled for chloride again next year. This additional sampling may help us identify what areas of the watershed are contributing to the increasing in-lake conductivity.

Please note that the DES Limnology Center in Concord is able to conduct chloride analyses, free of charge. As a reminder, it is best to conduct chloride sampling in the spring as the snow is melting and during rain events.

- **Table 8: Total Phosphorus**
  Table 8 in Appendix B presents the current year and historical total phosphorus data for in-lake and tributary stations. Phosphorus is the nutrient that limits the algae's ability to grow and reproduce. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

  The phosphorus concentration in the **Outlet** was ***relatively low*** this year. However, we recommend that your monitoring group sample the major tributaries to the pond during snow-melt and periodically during rainstorms to determine if the phosphorus concentration is ***elevated*** in the tributaries during these times. Typically, the majority of nutrient loading to a lake or pond occurs in the spring during snow-melt and during intense rainstorms that cause soil erosion and surface runoff and within the watershed.

  For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at ***http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm****, or contact the VLAP Coordinator.*

- **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**
  Table 9 in Appendix B shows the dissolved oxygen/temperature

profile(s) collected during **2008**. Table 10 in Appendix B shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of sufficient amounts of dissolved oxygen in the water column is vital to fish and amphibians and bottom-dwelling organisms. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

EAST AND WEST STATIONS
The dissolved oxygen concentration was ***high*** at all deep spot depths sampled in the pond on the **May** sampling event. Typically, shallow lakes and ponds that are not deep enough to stratify into more than one or two thermal layers will have relatively high amounts of oxygen at all depths. This is due to continual lake mixing and diffusion of oxygen into the bottom waters induced by wind and wave action.

The dissolved oxygen concentration was greater than **100 percent** saturation at the **surface** of the **East Station**, and between the **surface** and **one** meter at the **West Station** deep spot on the **May** sampling event. Wave action from wind can dissolve atmospheric oxygen into the upper layers of the water column. Layers of algae can also increase the dissolved oxygen in the water column, since oxygen is a by-product of photosynthesis. Considering that the depth of sunlight penetration into the water column was approximately **2.5** meters at each station on this sampling event, we suspect that an abundance of algae in the epilimnion caused the oxygen super-saturation. It is also important to note that the dissolved oxygen concentration was greater than 100 percent between **three** and **four** meters at the **West Station**. A layer of cyanobacteria may have potentially caused the oxygen supersaturation at this depth. Cyanobacteria can regulate their buoyancy in the water column and often move to deeper depths to uptake readily available nutrients.

- **Table 11: Turbidity**
  Table 11 in Appendix B lists the current year and historical data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the "Other Monitoring Parameters" section of this report for a more detailed explanation.

  As discussed previously, the **West Station** hypolimnetic (lower layer) turbidity was ***elevated*** (**4.54 NTUs**) on the **8/11/2008** sampling event. This suggests that the pond bottom may have been disturbed by the anchor or by the Kemmerer Bottle while sampling and/or that the lake bottom is covered by an easily disturbed, thick organic layer of sediment. When the pond bottom is disturbed, phosphorus rich sediment is released into the water column. When collecting the hypolimnion sample, make sure that there is no sediment in the Kemmerer Bottle before filling the sample bottles.

The turbidities of the **East Station** epilimnion (upper layer) samples were ***elevated*** (**4.14, 6.35, 4.84,** and **3.72 NTUs**) on the **6/17/2008, 6/29/2008, 7/14/2008,** and **7/27/2008** sampling events. This suggests that a rainstorm may have recently contributed stormwater runoff to the pond and/or an algal bloom had occurred in the lake.

- **Table 12: Bacteria (*E.coli*)**

Table 12 in Appendix B lists the current year and historical data for bacteria *(E.coli)* testing. *E. coli* is a normal bacterium found in the large intestine of humans and other warm-blooded animals. *E.coli* is used as an indicator organism because it is easily cultured and its presence in the water, in defined amounts, indicates that sewage **may** be present. If sewage is present in the water, potentially harmful disease-causing organisms **may** also be present.

Bacteria sampling was not conducted this year. If residents are concerned about sources of bacteria such as failing septic systems, animal waste, or waterfowl waste, it is best to conduct *E. coli* testing when the water table is high, when beach use is heavy, or immediately after rain events.

- **Table 13: Chloride**

Table 13 in Appendix B lists the current year and the historical data for chloride sampling. The chloride ion (Cl^-) is found naturally in some surfacewaters and groundwaters and in high concentrations in seawater. Research has shown that elevated chloride levels can be toxic to freshwater aquatic life. In order to protect freshwater aquatic life in New Hampshire, the state has adopted **acute and chronic** chloride criteria of **860 and 230 mg/L** respectively. The chloride content in New Hampshire lakes is naturally low, generally less than 2 mg/L in surface waters located in remote areas away from habitation. The median epilimnetic chloride value for New Hampshire lakes and ponds is **5 mg/L**. Higher values are generally associated with salted highways and, to a lesser extent, with septic inputs. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

The **East** and **West Station epilimnions** were sampled for chloride during the **6/17/2008, 8/11/2008,** and **8/25/2008** sampling events. The mean epilimnetic chloride concentrations were **206.7 mg/L** at the **East Station** and **143.3 mg/L** at the **West Station**. Results are ***much less than*** the state acute chloride criteria and

slightly less than the chronic chloride criteria. However, these concentrations are ***much greater than*** what we would normally expect to measure in undisturbed New Hampshire surface waters.

The **Storm Outfalls #1 and #2** were sampled for chloride on the **2/14/2008** sampling events. The results were **7,710 and 2,750 mg/L**, which are ***much greater than*** the state acute and chronic chloride criteria. These stations were sampled following **2.0 inches** of rainfall in the previous **24 hours**. Both outfalls discharge stormwater draining major state and city roadways. The chloride levels are directly influenced by road salting practices on these roadways.

We recommend that your monitoring group continue to conduct chloride sampling in the epilimnion at the deep spot and in the tributaries near salted roadways, particularly in the spring soon during snow-melt and during rain events during the summer. This will establish a baseline of data that will assist your monitoring group and DES to determine lake quality trends in the future.

Please note that chloride analyses can be run free of charge at the DES Limnology Center. Please contact the VLAP Coordinator if you are interested in chloride monitoring. In addition, it is best to conduct chloride sampling in the spring as the snow is melting and during rain events.

In addition, if your group is concerned about salt use on a particular roadway, we recommend contacting the town road agent or the Department of Transportation to discuss the implementation of a low-salt area near the lake and/or its major tributaries. We also recommend that your group work with watershed residents to reduce the application of chloride containing de-icing agents to driveways and walkways.

*To learn more about conductivity and chloride pollution and what can be done about to minimize it, please refer to the 2004 VLAP Annual Report special topic article, which is posted on the VLAP website at **http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm**, or contact the VLAP Coordinator.*

- **Table 14: Current Year Biological and Chemical Raw Data**
  Table 14 in Appendix B lists the most current sampling year results. Since the maximum, minimum, and annual mean values for each parameter are not shown on this table, this table displays the current year "raw," meaning unprocessed, data. The results are sorted by station, depth, and then parameter.

- **Table 15: Station Table**
  As of the spring of 2004, all historical and current year VLAP data are included in the DES Environmental Monitoring Database (EMD). To facilitate the transfer of VLAP data into the EMD, a new station identification system had to be developed. While volunteer monitoring groups can still use the sampling station names that they have used in the past and are most familiar with, an EMD station name also exists for each VLAP sampling location. Table 15 in Appendix B identifies what EMD station name corresponds to the station names you have used in the past and will continue to use in the future.

DATA QUALITY ASSURANCE AND CONTROL

During the annual visit to your pond, the biologist trained your group how to collect samples at the deep spot and the outlet. Your group learned very quickly and did a great job following instructions.

In future years, the biologist will conduct a "Sampling Procedures Assessment Audit" of your monitoring group during the annual visit. Specifically, the biologist will observe the performance of your monitoring group while sampling and will document the ability of the volunteer monitors to follow the proper field sampling procedures (as outlined in the VLAP Monitor's Field Manual). This assessment is used to identify any aspects of sample collection in which volunteer monitors fail to follow proper procedures, and also provides an opportunity for the biologist to retrain the volunteer monitors as necessary. This will ultimately ensure that the samples that the volunteer monitors collect are truly representative of actual lake and tributary conditions.

Sample Receipt Checklist:

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if your group followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did a ***very good*** job when collecting samples this year! Specifically, the members of your monitoring group followed the majority of the proper field sampling procedures when collecting and submitting samples to the laboratory. However, the laboratory did identify a few aspects of sample collection that your group could improve upon, as follows:

- **Sample holding time:** Please remember to return samples to the laboratory **within 24 hours of sample collection**. This will ensure that samples do not degrade before they are analyzed. If you plan to sample on the weekend, please sample on Sunday, preferably in the afternoon, and return samples to the laboratory first thing on Monday morning to ensure that samples can be analyzed within 24 hours. ***E.coli*** **samples that are more than 24 hours old will not be accepted by the laboratory for analysis.**

USEFUL RESOURCES

Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials, DES Booklet WD-03-42, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-03-42.pdf.

Erosion Control for Construction in the Protected Shoreland Buffer Zone, DES fact sheet WD-SP-1, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-1.pdf.

Impacts of Development Upon Stormwater Runoff, DES fact sheet WD-WQE-7, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/aot/documents/wqe-7.pdf.

Low Impact Development Hydrologic Analysis. Manual prepared by Prince George's County, Maryland, Department of Environmental Resources. July 1999. To access this document, visit www.epa.gov/owow/nps/lid_hydr.pdf or call the EPA Water Resource Center at (202) 566-1736.

Low Impact Development: Taking Steps to Protect New Hampshire's Surface Waters, DES fact sheet WD-WMB-17, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-17.pdf.

Road Salt and Water Quality, DES fact sheet WD-WMB-4, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-4.pdf.

Shorelands Under the Jurisdiction of the Comprehensive Shoreland Protection Act, DES fact sheet SP-4, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-4.pdf.

Watershed Districts and Ordinances, DES fact sheet WD-WMB-16, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-16.pdf

New Hampshire Stormwater Management Manual, DES Publications WD-08-20B and WD-08-20C, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/publications/bmps_guides.htm.